USER MANUAL OF THERMAL POWER PLANT (TPP) SIMULATOR SOFTWARE

This is the manual for Thermal Power Plant (TPP) Simulator laboratory exercise. The manual consists of useful information about simulator software, which helps the user to get familiar with software interface, operation and functions. It is highly recommended to read the manual before start to work with the simulation exercise as well as to print it out and have it available during the simulation.

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1. The mouse (two bottoms)

Left button - open valves, start pumps
Right button - close or stop
Mouse over - shows information about valves, pumps

2. Keyboard function keys

Present windows layout:

F1	Run simulation
F2	Freeze simulation
F3	Stop the simulation, and exit the application
F4	Snapshot
Shift F4	Replay
F5	Operating condition
F6	Recall picture
Shift F6	Initial condition
F8	Alarm log
Shift F8	Page acknowledge (Alarm)
F10	Variable list
F11	Alarm list
Home	Picture directory
Shift Home	Select picture
Page up	Previous picture
Page down	Next picture

Download keyboard layout (PDF)

3. Initial conditions

“Initial Conditions” is a description of a specific situation. Loading an initial condition (exercise) implies that you together with the model itself also load a set of parameters that describe the starting point of your simulation.

To reach a specific training objective, the instructor normally needs to modify the “Initial Condition”. If you change the value of one of the above mentioned variables and store it, you have in fact created a new Initial Condition. It is possible to change the variables, define new initial concision and save it. An Initial condition must be chosen prior to starting the simulation. Snapshots can be converted to initial conditions too.

4. Picture directory

- Press [Home] key to get **Picture Directory**
- Select one of the options and view **Process Display**

5. Run & freeze simulation

Run
To set the simulator in Run mode, press the ***Run*** pushbutton [F1].

The indication in the header bar changes from ***Freeze*** to ***Running*** indicates that the simulator is in Run mode.
The simulated time displayed in the header bar of the display starts incrementing.

Freeze
To set the simulator in Freeze mode, press the **Freeze** pushbutton [F2] on the keyboard.
The mode indication in the header bar changes from ***Running*** to ***Freeze***.
The simulated time displayed in the header bar of the display stops incrementing.

6. Snapshots

A snapshot is a copy of all the variables and parameters needed to describe the state of the simulator. A snapshot consists of one or more binary files stored on the system hard disc and can be seen as a "picture" of the simulated plant state at a given time. Snapshots will only exist during a training session and cannot be transferred to or used in later training sessions unless they are converted into initial conditions. A snapshot is marked with the simulated time when it was taken and is identified by this time mark.

There are two ways to take snapshots, automatically or manually.

Automatic snapshots
Snapshots are taken automatically when setting the 'snapshot interval'. Default snapshot interval at simulation start-up is 00:00, i.e. no snapshots taken automatically. However, setting the 'snapshot interval' to 00:10 will cause snapshots to be taken at 10 minutes intervals.

Manual snapshots
To force a snapshot to be taken independently of the set snapshot frequency, press the **Snapshot** pushbutton. This permits the saving of situations not captured by the "automatic snapshot" feature.

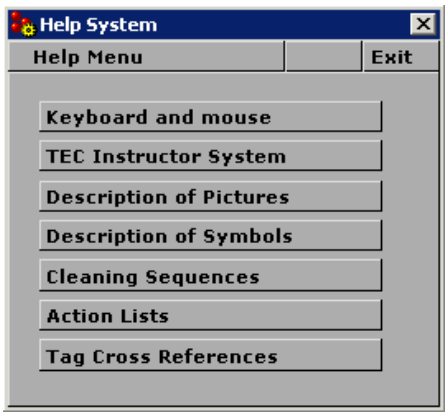
Snapshots saved using the auto snapshot facility are most often used for this purpose. Up to 100 snapshots may be saved and are thus accessible from the snapshot directory during a training session.

Snapshots are used for:

1. Creating initial conditions
2. Performing a replay
3. Do a backtrack

7. Simulator help menu

The simulator includes a help system. At the bottom of right corner there is a help function button, which gives clear information of the pictures of the plant, symbols, keyboard and mouse, functions, etc. For each main display it is possible to activate sub windows with relevant help information.



8. Pop-up windows

“Variable list”, **“Malfunction list”**, and **“Alarm list”** keys contain pop-up windows with more information about the process.

9. Process pictures

The simulator comprises the following process pictures:

Picture no.	Picture name
010	Steam Plant Overview
100	Fuel Oil System
120	Secondary Steam System
140	Burner Plane A
150	Burner Plane B
160	Burner Plane C
170	Burner Plane D
180	Boiler Consumption Control
190	Block Master Control System
200	Combustion Air/Flue Gas System
210	Combustion Air Preheaters
240	Boiler Water System
250	Boiler Steam System
260	Main Steam Lines
300	Steam Turbines
380	Electric Generator
400	Cold Condenser System
410	Main Condensate system
420	Low Pressure Feed Heaters
430	Feed Water Deaerator System
440	High Pressure Feed Heaters
500	Make-up Deaerator
600	Hot Condenser System
610	Direct Heater System
700	Denox Plant
710	SCR Reactor 1
720	SCR Reactor 2

800	Desulphurization Plant
810	Lime Silo
820	Slake System
830	Feeder System
840	Absorber
850	Product System
860	Mixing System

Colour cods for pictures

The following colours are used to indicate the various mediums:

Medium	Colour
Oil	Magenta
HP steam	Red
Air	White
Water	Blue

10. Variable lists

All model variables are listed in pop-up lists provided. The variable lists are activated by pressing [F10] key. The lists include tag name, descriptive text and alarm status, where applicable and actual value at the present state of the simulation.

The value of an independent variable can be changed in the variable list. The dependent variables are those are continuously updated by the simulator. It is not possible to change the dependent variables.

11. Malfunctions

Many of the components included in the simulator are capable of being in a faulty condition or having malfunctions. The instructor can set/reset faults on the malfunction pages, which are pop-up lists similar to the variable lists. The user does also have access to the malfunction lists, but the state of the malfunction is hidden for the user.

12. Description of pictures

Available in the simulator help menu

13. Description of symbols

Available in the simulator help menu

14. Simulator speed ratio

It is possible to change simulator speed ratio up to 5 times normal speed. Set simulation speed to 5 means that clock run 5 times faster than normal.

- Click on “speed ratio” section
- Set speed ratio
- Press [Enter] to save the data

Note: Before changing speed ratio make sure simulation is stopped

15. Alarm system

Information about **Alarms** can be found on the “Alarm page” [F8]

- when alarm runs, it is indicated in the section “Alarm Group”
- in order to see the details of the alarms go to “Alarm Log Summary Display” page [F8]
- right click the mouse on the alarm to acknowledge it

16. Instructor help

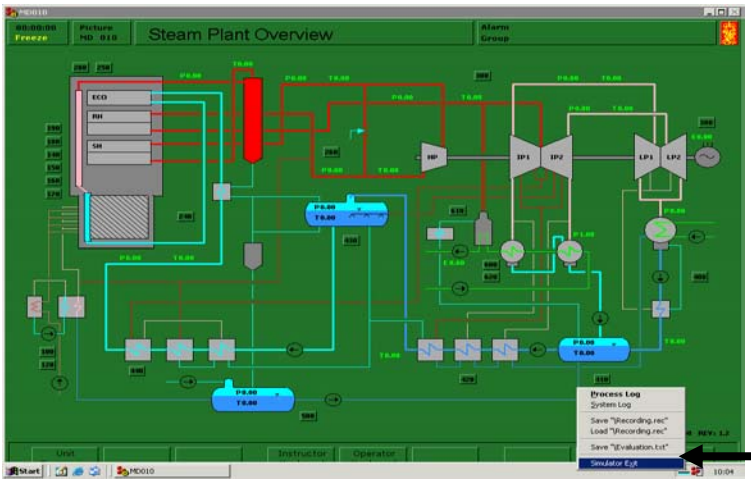
For more information contact Tommy Anderson by e-mail: tommyt@egi.kth.se

17. Exit the simulator software

There are two options to exit power plant simulator software

First option

- right click on task bar icon of power plant simulator
- select “**Simulator Exit**”(see the picture)
- left click on “**Simulator Exit**”



Second option

- press [F3] key
- press [Y] key
- press [Enter] key

18. Operational modes

Power Plant Simulator software has two operational modes:

1. Instructor mode
2. Operator mode

General overview of power plant simulator layout